

CLAIMS

1. A mass spectrometer including,
a source for producing particles including ions representative of chemical
5 elements in a sample together with neutral particles and photons,
an ion optics system contained in a first vacuum region for receiving
particles from the source, the ion optics system including
at least one first electrode for establishing an electrostatic field for
directing a beam of said ions in a first direction from the source and at
10 least one second electrode for establishing an electrostatic field for
diverting the beam of ions from the first direction through an angle
whereby neutral particles and photons emanating from the source
continue in the first direction and are separated from the beam of ions,
a quadrupole mass analyser arrangement contained in a second
15 vacuum region and including
a set of quadrupole fringe electrodes for receiving the beam of ions, and
a linear quadrupole mass analyser for receiving ions directly from the set
of quadrupole fringe electrodes, and
an ion detector also contained in the second vacuum region for receiving
20 ions from the linear quadrupole mass analyser,
wherein the set of quadrupole fringe electrodes are configured to divert
the ions prior to their passage into the linear quadrupole mass analyser and to
shield the linear quadrupole mass analyser entrance.
- 25 2. A mass spectrometer as claimed in claim 1 wherein the at least one
second electrode is for establishing an electrostatic field for diverting the beam
of ions from the first direction through an angle and in a second direction, and
the set of quadrupole fringe electrodes of the quadrupole mass analyser
arrangement receive the beam of ions in the second direction and shield the
30 linear quadrupole mass analyser entrance as viewed in the second direction.
3. A mass spectrometer as claimed in claim 1 or claim 2 wherein the ion
optics system includes a first set of electrodes for establishing the electrostatic
field for directing the beam of ions in the first direction, and a second set of

electrodes for establishing the electrostatic field for diverting the beam of ions from the first direction through said angle.

4. A mass spectrometer as claimed in claim 2 wherein at least one or more electrodes of the ion optics system are for establishing a reflecting electrostatic field for diverting the beam of ions from the first direction through said angle and in the second direction.

5. A mass spectrometer as claimed in any one of claims 1 to 4 wherein the electrodes of the set of quadrupole fringe electrodes are elongate and curved to thereby define a curved path to divert the ions prior to their passage into the linear quadrupole mass analyser.

6. A mass spectrometer as claimed in claim 5 wherein the electrodes of the set of quadrupole fringe electrodes are curved such that the ions exit the set of quadrupole fringe electrodes generally in the same direction as they enter the set of quadrupole fringe electrodes, whereby an entrance end and an exit end of the set of quadrupole fringe electrodes are substantially parallel but not co-linear.

7. A mass spectrometer as claimed in claim 5 wherein the electrodes of the set of quadrupole fringe electrodes are doubly curved such that the ions exit the set of quadrupole fringe electrodes generally in the same direction as they enter, whereby an entrance end and an exit end of the set of quadrupole fringe electrodes are substantially parallel and co-linear.

8. A mass spectrometer as claimed in claim 5 wherein the electrodes of the set of quadrupole fringe electrodes are curved such that the ions exit the set of quadrupole fringe electrodes in a direction generally at 90° to the direction in which they enter.

9. A mass spectrometer as claimed in any one of claims 1 to 4 wherein the electrodes of the set of quadrupole fringe electrodes are elongate and straight, and are tilted relative to an entry direction for the ions into the set of quadrupole

fringe electrodes to thereby divert the ions from that direction prior to their passage into the linear quadrupole mass analyser.

10. A mass spectrometer as claimed in any one of claims 1 to 9 wherein the set of quadrupole fringe electrodes are configured such that as viewed in an entry direction for the ions into the set of quadrupole fringe electrodes, the electrodes of the set at least cover and thereby shield the linear quadrupole mass analyser entrance and thereby also shield the detector.
11. A mass spectrometer as claimed in any one of claims 1 to 10 wherein the angle through which the beam of ions is diverted from the first direction is at least 10° .
12. A mass spectrometer as claimed in claim 2 wherein the angle between the first direction and the second direction is substantial, being greater than 10° .
13. A mass spectrometer as claimed in claim 12 wherein the substantial angle is about 90° .
14. A mass spectrometer as claimed in any one of claims 1 to 13 wherein the source for producing particles including ions representative of chemical elements in a sample together with neutral particles and photons is an inductively coupled plasma source.